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A NEW NOMENCLATURE FOR THE BROODS OF THE PERIODICAL CICADA.

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The writer reviewed the different nomenclatures suggested by various authors for the broods of the periodical Cicada in Bulletin No. 14, new series, of the Division of Entomology, and therefore a brief summary of the old systems is all that need be given here.

It will be remembered that the earlier writers, viz, Prof. Nat. Potter, Dr. William T. Harris, and Dr. G. B. Smith, classified the broods solely according to the years of their appearance. The unpublished register left by Dr. Smith includes every brood now known classified according to race, and gives the localities for one additional brood, the existence of which seems not to have been confirmed. Though lacking any special designation for the broods, Dr. Smith's classification is as complete and accurate as that published by Dr. Riley and since followed by all later writers. Dr. Asa Fitch was the first to introduce a numbering system for the different broods, enumerating nine altogether, but his data were very limited and he was not aware of the 13-year southern period, and there necessarily resulted no little confusion of the broods of the two races. The Walsh-Riley enumeration of 1878 gave the records for sixteen broods, which were designated by Roman numerals from I to XVI, the enumeration being based on the sequence of the different broods after 1868. In 1869, in his First Missouri Report, Dr. Riley, having in the meantime secured the manuscript paper of Dr. Smith, added the six broods from this paper not represented in the Walsh-Riley enumeration, increasing the number of the broods to XXII, and renumbered them again in accordance with their sequence, beginning with 1869. Several of these broods are rather unimportant, or lack confirmation, and one of them, Brood III, was founded on an erroneous record and has been dropped.

In the enumeration of the broods by Walsh-Riley, and later by Riley, the two races are mixed together and a sequence of numbers given which, after the first thirteen years, lost all significance as a record of the order of the broods in time of appearance, and from the first obscured the true kinship of the broods in each race. If, on the other hand, each race be considered separately and its broods be

arranged in a series in accordance with their sequence in time, an important natural relationship in point of origin and distribution is plainly indicated.

Taking first the broods of the 17-year race, it will be seen from the subjoined table that if the enumeration begin with Brood XI, the 17-year broods follow each other in regular succession for eleven consecutive years; then after a break of one year follows Broods V and VIII, and after another break of one year, Brood IX; another break of one year precedes the next recurrence of Brood XI, with which the series starts.

Chronological order of the broods of the Cicada from 1893 to 1910.

Year.	17-year race.	13-year race.	Year.	17-year race.	13-year race.
1893	XI	XVI	1902	XXII	.....
1894	XII	XVIII	1903	I	.....
1895	XIII	II	1904	.....	.....
1896	XIV	IV	1905	V	.....
1897	XV	VI	1906	VIII	XVI
1898	XVII	VII	1907	.....	XVIII
1899	XIX	.....	1908	IX	II
1900	XX	.....	1909	.....	IV
1901	XXI	X	1910	XI	VI

Taking up the 13-year broods in the same way, it will be seen that if the enumeration start with Brood XVI, a 13-year brood follows in regular succession for six years. With the exception of the very doubtful Brood X, which is separated from the last 13-year brood by three years, there follow seven successive years in which no 13-year broods occur.

Under the supposition that the different broods of the 17-year and 13-year races sprang in the remote past from an original brood of each, it would naturally follow that the broods most closely related in time would also present a closer relationship in their range, and this, in fact, proves to be generally true.

To show this relationship and to indicate the natural order of their occurrence, I have to suggest a new enumeration of the broods in which the two races are separated—the 17-year broods coming first, followed, for convenience merely, by the 13-year broods. Thus Brood XI of the 17-year race becomes Brood I, and the others are numbered in the regular order of their occurrence, except that I have assigned a brood number to each of the seventeen years. This leaves Broods XII, XV, and XVII, as newly numbered, without any definite colonies, so far accepted, as representatives of established broods. As will be shown later, however, there are records which indicate the existence of small or scattering broods filling the three gaps mentioned in the 17-year series.

In the renumbering the broods of the 13-year race I have continued for convenience from the end of the series of the 17-year race, the first 13-year brood becoming Brood XVIII, and I have assigned

brood numbers to each year of the 13-year period, making a total enumeration of the broods of both races of XXX. As already indicated, six of the numbers given to the 13-year race have had no brood assigned to them, although records have been secured which seem to indicate the existence of scattering broods filling some of the gaps, as will be noted in the records given further on.

It does not necessarily follow, in fact it is quite unlikely, that Brood I, as here designated, is the original or oldest brood of the 17-year race. Undoubtedly some of the 17-year broods, perhaps half or more of them, originated by retardation of individuals, and perhaps half by acceleration of individuals; so that the original brood, if it still exists, is more likely to be one of the intermediate ones. Brood X, being the largest of the 17-year broods, perhaps has best claim to this distinction.

For the same reasons an intermediate brood in the 13-year series is doubtless the original brood of the 13-year race, and this title may possibly belong to Brood XIX which has the widest range of all the broods of the 13-year race. The fewer number of broods in this race would seem to indicate that it is of later origin than the 17-year race, and this belief is further justified by the fact of its occupying, in the main, a territory of later geographical formation.

The following table, beginning with 1893, when the initial broods of both the 17-year and the 13-year series appeared in conjunction, illustrates the new nomenclature suggested, and in parallel columns also are given the corresponding nomenclatures proposed by Professor Riley, by Walsh and Riley, by Fitch, and the year records in Dr. Smith's register:*

Nomenclatare of the broods of the periodical Cicada.

Year.	Broods of the 17-year race.					Broods of the 13-year race.				
	Proposed enumeration.	Riley numbers.	Walsh-Riley numbers.	Fitch numbers.	Smith register.	Proposed enumeration.	Riley numbers.	Walsh-Riley numbers.	Fitch numbers.	Smith register.
1893	I	XI	.....	.....	1842	XVIII	XVI	.....	.....	1854
1894	II	XII	VIII	1	1843	XIX	XVIII	XIII	3	1842–1855
1895	III	XIII	IX	.....	1844	XX	II	.....	.....	1843
1896	IV	XIV	X	.....	1845	XXI	IV	.....	.....	1844
1897	V	XV	XI	.....	1846	XXII	VI	IV	.....	1845
1898	VI	XVII	XII	7	1847	XXIII	VII	V	5	1846–1859
1899	VII	XIX	.....	.....	1848	XXIV	.....	.....	.....	.....
1900	VIII	XX	XIV	2–8	1849	XXV	.....	.....	.....	.....
1901	IX	XXI	XV	5	1850	XXVI	X	.....	.....	1849
1902	X	XXII	XVI	4	1851	XXVII	.....	.....	.....	.....
1903	XI	I	I	9	1852	XXVIII	.....	.....	.....	.....
1904	XII	.....	II	.....	1853	XXIX	.....	.....	.....	.....
1905	XIII	V	III	6	1854	XXX	.....	.....	.....	.....
1906	XIV	VIII	VI	3	1855	XVIII	XVI	.....	.....	1854
1907	XV	.....	.....	.....	.....	XIX	XVIII	XIII	3	1842–1855
1908	XVI	IX	VII	.....	.....	XX	II	.....	.....	1843
1909	XVII	.....	.....	.....	.....	XXI	IV	.....	.....	1844

*In Bul. 14, Div. Ent., U. S. Dept. of Agr., the Riley numbers given in column 2 were employed, and should be corrected to the later enumeration indicated in column 1.

THE RELATIONSHIP OF THE DIFFERENT BROODS.

As a rule the relationship of the broods in point of distribution agrees with their kinship as indicated by their sequence in time of appearance. The relationship indicated by the latter, viz, their sequence in time, is doubtless untrustworthy as indicating origin, in some instances, on account of the uncertainty arising from the action of the principle of retardation on the one hand and acceleration on the other in the forming of new broods.

In the case of a widely scattered brood, like Brood VI, it is quite possible that certain swarms originated from a later-appearing brood by retardation of individuals, and other swarms from an earlier brood by acceleration in time of appearance of individuals.

This same condition may be true of other of the more scattered broods, but with the broods presenting a compact range a singleness of origin is evident.

Examination of the distribution of the broods in connection with their sequence in time of appearance indicates, however, a certain relationship between the different broods in point of origin, which may be indicated as follows:

THE RELATIONSHIP OF THE 17-YEAR BROODS.

From the standpoint of distribution the broods of the 17-year race may be grouped as follows: (1) Broods I and II; (2) Broods III and IV; (3) Brood V; (4) Brood VI; (5) Broods VII, VIII, IX, X, and XI; (6) Broods XII, XIII, XIV, and XV; (7) Broods XVI and XVII, the last connecting again with Brood I.

Taking up these broods in regular order:

The main body of Brood I occupies territory immediately west of the more important Brood II, and also presents a number of colonies extending westward to Colorado. Broods I and II seem, therefore, closely allied in point of origin.

Brood III presents little, if any, relationship to Brood II in point of location and distribution, but is closely allied to the following brood, IV, and the latter is evidently a western and southern extension of III.

Brood V presents little relationship with Brood IV in point of distribution and covers a very compact territory.

Brood VI, being a widely scattered one, and occurring usually in small numbers, does not seem to present any particular relationship with any of the preceding or following broods.

Brood VII is local in distribution and not very important, and is divided into two sections by the territory occupied by the following Brood VIII, with which it thus seems to be closely allied. Brood IX is very distinctly a southern extension of Broods VII and VIII.

These three broods seem, therefore, to be closely allied in their origin, and, curiously enough, occupy territory which divides the two main sections of the great 17-year Brood X, which next follows in regular succession. Brood XI, following X, is evidently an extreme northeastern extension of the latter.

Brood XII, immediately preceding XIII, is represented by a series of colonies connecting the western Brood XIII with group 5. Brood XIII is the principal representative of group 6 and represents a large western group of the 17-year race of group 6, which comprises the main western branch of the 17-year race, as group 5 clustered about X is the principal representative of the eastern branch of the same race. Brood XIV has a very wide range to the eastward of XIII, and connects with the latter through the colonies in northern Illinois and Indiana. Brood XV, following XIV, is limited to the Atlantic seaboard with the exception of one doubtful colony in Indian Territory, and connects directly with the eastern colonies of XIV.

Brood XVI is based on somewhat doubtful records, the Colorado locality perhaps being due to confusion with some other species, and the other records needing confirmation. Brood XVII is intermediate between Brood XVI and Brood I, its western colonies connected with the former and the eastern colonies with the latter.

THE RELATIONSHIP OF THE 13-YEAR BROODS.

The broods of the 13-year race break up into the following natural groups: (1) Related closely to Brood XIX, and comprising Broods XVIII, XIX, and XX; and (2) related to Brood XXIII, and comprising Broods XXI, XXII, XXIII, and our new Brood XXIV.

The first of these broods, Brood XVIII, is a rather insignificant one and is undoubtedly an eastern extension or offshoot of the great 13-year Brood XIX, which succeeds it. Brood XX is undoubtedly a section of Brood XIX retarded one year, just as Brood XVI is an accelerated swarm of the same. Both represent eastern extensions of the parent brood.

Brood XXI, separated from Brood XIX by two years, seems to bear little relationship to the latter, and a more logical arrangement consists in connecting it with Brood XXIII through Brood XXII, of which last it may be considered as an eastern and northern extension. Brood XXII is a very marked instance of the formation of a new brood by an acceleration in time of the appearance of a portion of a larger and older brood. Its relationship with Brood XXIII is very marked and can not be questioned. Brood XXIII, the main representative of this group, is followed by the new Brood XXIV, which is evidently a retarded swarm of the preceding brood.

Of the new Broods XXIX and XXX, both of which need verification, no significant relationship can be pointed out.

Brood XXIX is very doubtful, and the records are possibly based on confusion with the 17-year race.

NEW BROODS 17-YEAR RACE.

Brood XII, 1904.—If his records are correct, this brood is the one referred to by Dr. G. B. Smith as occurrring in 1853 in Vinton County, Ohio, and Jo Daviess County, Ill. Its recurrence seems not to have been recorded either in 1870 or 1887, and Smith's records are therefore open to question.

Mr. J. R. Burke, Milton, Cabell County, W. Va., writing under date of May 22, 1897, says: "The Cicada is not due here until 1904; its last visit was in 1887."

Mr. W. S. Herrick, Thurman, Allen County, Ind., writes under date of June 10, 1898, that "We had the 17-year locust in 1887, if I remember correctly." This is also a doubtful record, and it is possible that he referred either to Brood XXII, occurring in 1885, or Brood V, occurring in 1888.

That all these records are open to some doubt is apparent, but they are of sufficient importance to warrant investigation in 1904.

Brood XV, 1907.—This brood is represented by the colony appearing at Tivoli, Duchess County, and Galway, Saratoga County, N. Y., in June, 1890, as recorded by Prof. J. A. Lintner in his Seventh Report, pages 297–301. Mr. Davis records the occurrence of scattering individuals the same year on Staten Island. In a letter of June 2, 1890, Prof. J. B. Smith, New Brunswick, N. J., reports that the periodical Cicada had been taken by several Newark collectors, and had also been observed at Anglesea, Cape May County.

Another record which perhaps applies to this brood is given by Mr. I. N. Smith, Scotland Neck, Halifax County, N. C., in letter of June 22, 1885. He reports that his "First recollection of the locust was about the year 1839 or 1840, when the whole of the white-oak lands were filled with them. * * * In 1855 or 1856 they appeared again, but nothing to compare with the period first stated. The locusts were all on the white-oak land and on the Roanoke River and not on the pine lands." Assuming the dates 1839 and 1856 to be the correct ones, this would throw this swarm of Cicadas into Brood XV, and if there are any representativs left they should reappear in 1907.

The late Mr. W. S. Robertson, of Muscogee, Ind. T., in a letter of June 17, 1879, incidentally mentioned also the occurrence of a brood of Cicadas 1839. This record could not fall in any one of the old broods, and if it belongs to the 17-year race it would be an extreme western outpost of XV.

Brood XVII, 1909.—A very definite record which may coincide with this brood is furnished by Mr. Theodore Pergande, of this Division, who states that Mr. Rosseau, of Charlottesville, Albemarle

County, Va., informed him that the Cicada was very numerous in that place in 1875. His informant was positive as to the year from its being the one in which he made a trip to Europe.

Another record is given by Mr. John D. Macpherson, Manassas, Prince William County, Va., in letter of July 3, 1895. He writes: "I came here on the 23d of June, leaving the Cicada in full song in Washington (Brood X). Finding none here, I made inquiry and was informed that they appeared in full force in this county (Prince William) in the year 1875. This information I regard as reliable, the date being fixed as the year following the marriage and arrival of my informant in this county." These Virginia swarms are evidently precursors of Brood I, with which they are therefore closely allied.

A western extension of this brood seems to be indicated in the record furnished by H. J. Giddings, Sabula, Jackson County, Iowa. He writes, "during last June (1892) the periodical Cicada was quite common here. * * * I thought it was unusual to find them in such numbers four years after their regular appearance. The last regular year was 1883." (See Insect Life, Vol. V, page 200.)

If belonging to the 17-year race, the two records following should also be assigned to this brood. Mr. A. J. Julian, Woolleys Ford, Hall County, Ga., reports under date of June 14, 1898, that the Cicada was present there in 1892. Mr. J. W. Seaton, Strasburg, Cass County, Mo., writes under date of June 9, that the Cicada last appeared in that county in the summer of 1892 and in the summer of 1896, being numerous both years. The 1896 record refers to the 17-year Brood IV, and hence the record of 1892 is probably also of the 17-year race occurring in the same district.

The scattering specimens recorded by Mr. Davis as occurring on Staten Island in 1892 may also be assigned to this brood.

NEW BROODS, 13-YEAR RACE.

Brood XXIV, 1899.—Mr. P. Lynch, Commerce, Scott County, Mo., under date of December 24, 1874, reports that the Cicada appeared in the summer of 1873 in considerable numbers, coming in June and remaining about two months. "Their eastern limit in this county (Scott) was the Mississippi River, but they were as numerous on the opposite side of the river in Alexander County, Ill."

Mr. W. S. Campere, Pickens Station, Holmes County, Miss., writes under date of February 27, 1875, that the Cicadas appeared in great numbers in April, 1873. These two records would indicate a brood originating doubtless by retardation of individuals of Brood XXIII.

Brood XXIX, 1894.—It is possible that the following records apply to a 13-year race, and in that case should be assigned to our Brood No. XXIX.

Mr. C. J. Wellborn, Blairsville, Union County, Ga., writes under date of June 12, 1885, that "in May, 1878, locusts appeared south of this place and the northern limit then was the present southern limit of the territory covered now (by Brood X, 1885)."

Mr. James Pagon, Winnsboro, Fairfield County, S. C., writes that locusts appeared in South Carolina in 1878, but does not give definite localities. Both these records need confirmation.

Brood XXX, 1905.—Mr. B. H. Brodnax, Brodnax, Morehouse Parish, La., writes under date of May 13, 1892, that Cicadas are scatteringly present, and in a later letter he asserts that the insect in question is the periodical Cicada, with which he is familiar.

The records given above of new broods of the 13-year race are rather unsatisfactory, and it may be true that the 13-year race has not by any means distributed itself over its entire period, and the broods still cluster about the two main representatives of the race, namely Broods XIX and XXIII.

WASHINGTON, D. C., *May 1, 1902.*